

## Accelerator Systems Division Highlights for the Week Ending May 31, 2002

### ASD/LBNL: Front End Systems

This report covers the final week of commissioning activities for the Front End Systems at Berkeley. Rod Keller is on travel attending the High Current H-minus Workshop in Saclay this week and will attend the EPAC Conference next week.

The original plan for this 4-day week was to finish operations a day early, but a one day extension to include Friday was made to accommodate additional testing and development of the laser profile diagnostic. Following the Memorial Holiday, this Tuesday was devoted to preparations for a high current demonstration, the final remaining goal of the commissioning plan at Berkeley. Beam operations were set to begin on Wednesday, when we suffered a failure in the 100 kV anode power supply for the 1 MW klystron. Our technical support crew worked late into the evening to open the power supply and found a bad diode stack in the rectifier board. This was replaced with a spare board and beam operations were able to resume on Thursday. At approximately 1910 hours Thursday evening the SNS front end injector delivered a peak current of slightly over 40 mA into the beam stop at the end of the MEBT, exceeding the 38 mA level required to support SNS operations at 1.4 MW. Thursday's operations also permitted acquisition of laser profile data at a number of different beam currents and quadrupole settings.

On Friday, beam operations continued, and a new high current record was achieved: 50 mA of peak beam current were transmitted through to the MEBT beam stop. The system ran stably for several hours in the 48-50 mA range, just prior to shutting down. These runs were carried out using one jaw of the emittance device as the beam stop, limiting beam operations to low duty factor. Accordingly, these high current runs were all carried out at a repetition rate of 6 Hz, and a pulse width of 100 microseconds.

At 1500 hours on Friday, May 31, all FES beam operations at Berkeley were officially turned off.

There were many visitors from ORNL here this week participating in the final arrangements and planning for disassembly and shipping activities. Saeed Assadi (ORNL) and Craig Dawson (BNL) were also here conducting the tests with the laser profile monitor. Disassembly is scheduled to begin on Monday, June 3, and the next (second) truck is scheduled to leave Berkeley on Tuesday evening, June 4.

### ASD/LANL: Warm Linac

We started the 96-hour heat run on the second 402.5-MHz klystron on the LANL test stand. Tests have progressed smoothly to date, with more than 30 hours at 1.7-MW and full SNS repetition rate and pulse width. The klystron ran continuously all day today without a single trip from either the klystron or the prototype high-voltage converter modulator (HVCN). (WBS 1.4.1.1)

LANL and ASD staff, were at Marconi this week for factory acceptance testing of the third 402.5-MHz klystron. Tests continue to be encouraging with the achievement of full power and efficiency. A few high-order mode issues might linger, but we anticipate accepting the tube, at least conditionally. (WBS 1.4.1.1) Factory acceptance tests are progressing well on the third 402.5-MHz transmitter. (WBS 1.4.1.1) The modified prototype HVCN is under oil and back in operation. It was operated at 130-kV, 60-Hz, and 1.2-ms in support of the second 402.5-MHz klystron heat run. After over 30 hours, there have been no faults or trips in the converter modulator. (WBS 1.4.1.2)

The low-level RF field resonance control module (FRCN), clock distribution module, and high-power protect module are all in the same crate. The FRCN is now talking with the IOC talking via the VXI interface. This was a good step towards identifying gross errors that are often encountered during system integration. We found one bus problem that should be an easy fix. (WBS 1.4.1.3)

Rick Martineau was at ORNL this week to participate in the alignment of DTL Tank 3. (WBS 1.4.2.7) Coronado completed construction of the bridge coupler tuning fixture. It is now at LANL for testing and will be shipped next week to Accel. (WBS 1.4.4.7)

LANL submitted several PCRs this week: PCRs LI 02-021 and 02-026 are zero cost and realign BCWS based upon latest work package manager and/or vendor information. PCR LI 02-027 changes the contract with the LANL water skid vendor, AVANTech, to accelerate the delivery of DTL and CCL water skids, as requested by ASD. It will cost an additional \$64K. The accelerated delivery and change in sequence will benefit the current ASD installation schedule. PCR LI 02-028 is in response to ASD requests for revisions to the CCL and SCL BPM electrode geometry. It will cost an additional \$50K. The new geometry would improve the broadband impedance match and allow measurement of higher harmonics. In PCR LI 02-029, LANL will transfer \$450K to ORNL ASD to procure cables, connectors and to complete the electrical design packages for the DTL, CCL and SCL. (WBS 1.4.6.1).

#### **DTL Highlights**

Reassembly of the three DTL-3 tanks sections and realignment of the drift tubes was completed this week (see figure 1). Rick Martineau (LANL) participated in this activity. It was determined that the combination of disassembly/reassembly of the tank sections (bolting and unbolting flanges) and shipping and handling, resulted in DT misalignments up to about 0.010". The DT's were realigned within about 0.001", using the laser tracker. Tank tuning will begin next week and is scheduled to be complete on June 6.



Figure 1 - DTL-3 in RATS

### **ASD/JLAB: Cold Linac**

Two cavities in the prototype cryomodule have undergone preliminary testing. The results were encouraging, as both cavities achieved gradients in excess of 15 MV/m.

Two of four cold compressors have been shipped from the vendor.

### **ASD/BNL: Ring**

Fifteen papers and numerous posters have been prepared and submitted to EPAC.

Ring RF - a note to ASD from Jon Sandberg:

“We are about ready to begin production of the number two cavity and associated power supplies. We will also be completely disassembling the prototype unit. This would be an ideal time to send a technician to BNL to learn these systems in detail. I would recommend an extended stay (at least 6 months) here on Long Island in which time your technician would become an expert in all aspects of the RF cavity construction, installation and testing. Do you think this could be arranged?.....Jon”

Status of Ring dipole shimming: magnet #17 has been measured (16 type A + 1 prototype spare). Data from all 17 magnets are being restudied before we switchover to start measuring the 16 type B Ring dipoles.

BINP (30Q44): our vendor is scheduled to perform electrical tests starting today. QA will be provided by a third party under contract to BNL. Expect shipment to BNL in early June.

Craig Dawson traveled to Berkeley this week to support laser wire testing.

Bob Lambiase returned from IE Power where he reviewed the requirements/parameters for the medium range power supplies. Although complete to the 95% level, the final parameter list will remain “open” for another ten days to tie-up loose ends. When complete, the revised parameter list will be sent to Stuart Henderson, ASD.

IE Power has been given permission to ship the first article Injection Kicker PS to BNL. Upon arrival in about two weeks, we will connect this power supply to the assembled injection kicker magnet for full system testing.

A final order was placed with Apogee Labs for the PS Interface modules that are being built by them. The production quantity includes J-Lab, LANL, BNL and spares.

Tesla reported that they have shipped their “short” dipole (8D406) to SNS/OR.

A sole source justification is being prepared to award the production contract for the Injection Kicker Power Supplies.

One of the two prototype low field power supplies is being made ready for shipment to ORNL from BNL.

John Smith, Group Leader of SNS/BNL Controls begins his long planned, well deserved retirement after COB today. Larry Hoff will become the new Group Leader.

### **Controls**

This week marked the retirement of John Smith as Level Three Controls Team Leader at BNL. John gave us an excellent start at BNL, and the controls team as a whole always appreciated his experience and common sense. He will be missed. One (of many) important legacy will be the power supply controller system, which John championed against my own obstructionism (Dave Gurd). John was right, and these controllers will be used for power supplies across the entire SNS facility. Thanks John, and good luck in your retirement.

The control team continued to support Front End running until the bitter end, making modifications, additions and improvements all the way. A failed Ethernet switch was replaced. Inter-PLC communication was established, addressing a number of known cabling problems. Allen-Bradley output modules were set to hold their state in the

event of loss of PLC communication. This should prevent a recurrence of the vacuum event of two weeks ago. The system is complete, operational, tested, and ready to ship on the first of June.

At LANL, all LLRF boards (Utility, CDM, HPM and FRCM) were consolidated into one VXI crate for a system test. The FRCM still does not work correctly, putting spurious signals on the VXI backplane and disturbing all backplane communication.

The controls racks for HPRF, vacuum, RCCS, and power supplies are complete at LANL, and ready for shipping to ORNL Monday. The vacuum signal list, database, and other documentation are 80% verified.

Testing of the latest correlator version developed at LANL continues at ORNL. Results will be announced shortly to the EPICS community at large.

The controls team at Brookhaven received preliminary ICDs for LLRF and Beam Dumps/Collimators, and placed them on the BNL Controls web site. Work is now proceeding in those areas.

The Ring Title II design package for CF controls has been issued CFC.

23 of the 24 control valves needed for the entire FELK have been delivered to Sverdrup-Tullahoma and are being bar coded, etc. They will be shipped to the site on Wednesday next week. This will easily support the piping contractors need for valves. Other sensors needed for the FELK are arriving and by June 17 they will all be at the site.

FE building software and its Factory Acceptance Test (FAT) procedure is complete and going through preliminary testing. The official FAT is scheduled for Thursday next week. By the end of next week, all Controls Team responsibility for the FE will be complete and Conventional Facilities will take over for loop testing and startup.

The need for the backbone design has been delayed due to building readiness delays – possibly until FY03. We will work the CUB design package through drafting first and finish it in a week to ten days. This will allow our team to move onto the Target building package that is currently about 60% complete. We expect the 60% complete backbone package in 3 weeks.

Summary on CF Controls - we are way out in front of CF needs and probably several months ahead of schedule.

### **Accelerator Physics**

Half the group is preparing for EPAC, writing papers and preparing posters.

Tom Pelaia has put together a modern prototype electronic logbook which uses the Oracle database and which allows reading and writing from a web browser. A demonstration was made to the Division.

S. Kim has been working on the thermal analysis of the MEBT scrapers necessary for halo mitigation in the front-end. He has found a vendor of carbon-carbon material which has the necessary material properties. He is working with the vendor on specifications and cost.

### **Accelerator Systems Operations**

Submitted the “final” internal review round for the commissioning “Plan of Action”

Met with NEXTEL on the SNS cellular telephone communications approach including “in the tunnel” phone-pager-radio capability.

Reviewed the Report: Necessary And Sufficient Process Work Smart Standards For ES&H - the SNS Front End and Warm Linac.

Help in preparation of Electronic Logbook demonstration.

Finished general PPS Sweep and Access Procedures, and detailed procedure for DTL 3 Enclosure Sweep.

Began defining requirements for the Operator Interface to EPICS Control Screens.

Continued defining requirements of an improved Document Management System.

Continued helping others to get started using the Equipment Tracking System and Bar-Coding of equipment.

Continued writing the Operators Training Manual.

### **Ion Source Group**

#### **Cryogenics Group**

Transfer Lines:

Pipes are being cut to fabricate the next supply modules. This will be modules HB4/HB5 and HB6/HB7. Return Module MB3/MB4 is 70% completed.

CHL:

The roof sheeting is covering column lines 1-4 and the control room concrete floor has been poured. All the steel is delivered for column lines 10-17 in the RF building. Power has been connected to the warm compressor motor heater circuits.

Linac Tunnel:

Preparations are in place to move the 2 "T" sections and 6 supply transfer line modules into the tunnel on Monday 6/3/02. Also we are moving 62 pieces of 20 foot pipe for the warm gas tunnel piping contractor.

Personnel:

We continue to interview for the open technical positions of the JLAB Cryomodule work.

### **Electrical Systems Group**

Roy Cutler attended the NuMI semi-annual DOE review (Neutrinos using the Main Injector) at Fermi as the lead technical systems reviewer.

Roy Cutler visited IE Power in Toronto, Canada to attend a design review of the Medium Energy Power Supplies. Bob Lambiase of BNL also attended. Progress on construction of the first deliverable, a 5020A 18V supply was observed. During the visit, the prototype injection bump power supply, also built by IE Power, was approved for shipment to BNL. Overall schedules, including the construction of the CCL power supplies (also to be built by IE Power) were discussed.

Progress in the electrical installation in the Klystron building and the Front End Building have been slowed by interferences with the conventional facilities construction workers. Some technical systems cable trays installed 2 weeks ago have been removed to allow access by conventional facilities. This weeks report by Teresa Toomey:

We have set the Modulator Transformers and Secondary Switchgear for DTL-ME1 & DTL-ME2 on the concrete pads outside the Front End building. These are bolted together and bolted down to the pad. We will pull the power cable as soon as we can get back in the Gallery and rehang the cable tray that feeds the DTL-SCR equipment. CF does not have the primary gear here as yet, it is expected around June the 7, 2002.

We have pull the power circuits for the FE Comm room cabinets, we will complete the testing and termination of these cables next week.

The temporary control room cabinets are laid out so we can start pulling power circuits to these cabinets next.

All the tray hangers to support the Linac tunnel tray are built and ready for installation when CF gives us the tunnel on June 3, 2002

## **Survey and Alignment Group**

### **Beam Diagnostics**

#### **LANL Beam Diagnostics Progress Report:**

**BPM pickups:** Fabrication continues on the six remaining DTL BPMs. We have started the process to fabricate new BPMs for DTL tank 3. Negotiations continue with ISYS to fabricate the redesigned CCL and SCL pickups. Design changes to the SCL BPM mapping fixture will be necessary to accommodate the SCL BPM design changes driven by the new inter-segment region layout.

**BPM electronics:** John Power traveled to LBL last week to correct timing parameters, solve software problems, and take data to characterize the BPM system. Overall the system is working well, but there are still some software issues to be solved, and possibly a hardware issue with the self-calibration system.

**Wire scanner actuators:** Work continues at JLab to test the SCL wire scanner actuator. Fabrication continues at Huntington on the prototype and D-plate actuators. The prototype 3-inch and 6-inch actuators are due the end of June. We are waiting for vendor fabrication quotes for the new SCL beam box design.

**D-plate:** Detailing of the last major D-plate component is complete. Drawing checking is in progress. Many drawings have been released to vendors for fabrication. D-plate BPM pickup fabrication is in progress. The harp profile monitors from Princeton Scientific should ship 3/Jun.

**Cabling:** Work continues on cable specifications, rack layouts, wiring lists, and block diagrams.

#### **BNL Beam Diagnostics Progress Report:**

**1.5.7.1 BPM:** Work continues on tech-note and preparations for design review. Exploring details of PCI interface. PCR is in progress for additional 30cm BPMs for Ring vacuum chamber spares.

**1.5.7.2 IPM:** More tests were done with the luminescence gas profile monitor. The signals greatly increase when nitrogen is leaked into the chamber. An access was made to remove the test tape on the phototube so now we have all eight channels available. The software is being improved so the eight channels can be integrated to produce a profile. Additional data is imminent. The magnet used for the RHIC sextant test IPM was located. It plus a spare IPM vacuum chamber will be installed in RHIC for next run to test the 'optical IPM' concept.

**1.5.7.3 BLM:** Consulting with vendors regarding price and manufacturing engineering of the new detector design.

**1.5.7.4 BCM:** Parts kit is in preparation to stuff the new board.

**1.5.7.5 Tune:** A paper and poster were prepared for EPAC.

**1.5.7.6a Carbon Wire Scanner:** Preparations continue for refurbishment of the MEBT wire scanners.

**1.5.7.6b Laser Wire Scanner:** The laser profile monitor was opened to check on the condition of the optics. The optics are clear and the laser seems to be firing correctly. Further beam tests are planned in which we will focus the

ion beam to be narrow at the measurement point to enhance the laser-ion beam overlap. A group member traveled to Berkeley for MEBT laser wire measurements.

**ORNL Beam Diagnostics Progress Report:**

The third summer intern has joined the group. Summer projects are Web documentation, System management, and security plus setting automated test stands for the beam position monitors. Work continues on hardware and software standards for the NADs. Saeed and Craig Dawson went to Berkeley to take Laser wire data. They clearly observed the profile modifications vs. quad settings. Data will be analyzed within a week. Database work and installation preparations are under way. We are preparing the work list to bring the diagnostics from prototype to the production cycle. We are assessing the impact of diagnostic resources being assigned to LLRF. Several recovery plans are being evaluated.